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ABSTRACT

The paper examines decisionmaking guidelines for devising a microcomputer-aided augmentative communication device for non-vocal severely handicapped students. Four considerations are addressed: (1) candidates for microcomputer-based augmentative communication devices (motor development, sensory abilities, cognitive development); (2) instruction for operating the device (effects of learned helplessness, manipulative devices); (3) considerations in choice of speech output systems (intelligibility, social acceptability); and (4) the match between the system and the child (a case study illustrating selection of a symbol system). Appended material includes a summary of three demonstrated voice output devices and a description of Blissymbolics. (CL)

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AN EVALUATIVE MODEL FOR THE DEVELOPMENT AND IMPLEMENTATION OF A MICROCOMPUTER-BASED COMMUNICATION AID

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INTRODUCTION

The technology which has sent man to the moon, communication satellites into orbit, and provided affordable data processing systems for small business is now being adapted to serve as the hands and voice for the severely physically handicapped.

Microcomputers can now be accessed by activating a single switch or a light beam, allowing a quadriplegic to control many aspects of his environment. In the same way, these individuals can now use computer programs for recreational, educational, and vocational purposes.

Probably the most powerful of its functions, however, is its potential for providing a voice for the speechless. There are 1.5 million non-vocal severely physically handicapped individuals in the United States. Of these, 500,000 are school-aged children (Shane, 1985). Many of these children have the cognitive prerequisites for communication, however, their potential is literally locked within their disabled bodies.

Among the greatest challenges for the Speech/Language Pathologist is working with such clients. How does one facilitate expressive communication in the quadriplegic whose neuromotor problems so incapacitate the oral mechanism that speech is impossible? Such a challenge is addressed when

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the microcomputer is programmed to serve as an augmentative communication device. This presentation will describe several of the decision-making processes involved in devising a system which can be delivered in a cost-effective manner with currently available technology.

The promise of this technology cannot be denied, but its promise is not a panacea for all the severely disabled. We will explore four important considerations which must be addressed by those who would prescribe such systems:

I. Who are the candidates for microcomputer-based augmentative communication devices? Wendy Viger will provide some answers.

II. How does one teach the non-vocal severely physically handicapped child to operate the switching device which enables interaction with and control of the system? Karen Wilbert will give some practical and educationally relevant ideas.

III. What criteria should be used in the selection of a synthetic speech output system? Terri Johnson will discuss the major types of systems, demonstrate representative products, and share some preliminary research findings and projected future studies of their intelligibility.

IV. How can one assure compatibility of the system with its intended user? I will return to discuss what we consider to be essential characteristics of the user and the device that assure a long-term effective match-up. Tom Richardson will demonstrate the system which is our choice for the youngster who has been the focus of much of this research.

I. Who Are the Candidates for Microcomputer-Based Augmentative Communication Devices?

In order to determine which clients may benefit from the use of an augmentative communication device, the findings of a multidisciplinary evaluation must be considered. These findings will include impressions formed during systematic observation, as well as scores on formal tests.

The child who has been the impetus for this ongoing project is a 7½ year old boy, CW, who has cerebral palsy of the tension-athetoid type. He is quadriplegic and, because of the severity of his neuromotor involvement, has a poor prognosis for the development of spoken language.

Our work with him will be reported within the context of a model for the development of a communication system employing a microcomputer. The findings of a multidisciplinary evaluation will be discussed with reference to his candidacy for augmentative communication.

Briefly, prerequisite criteria for considering an augmentative system include: (1) no intelligible single word utterances, (2) cognitive development at least at Piaget's Stage 6, and (3) production of performative behaviors (Chapman & Miller, 1980).

CW met each of these criteria. The next step was to have him evaluated by a multi-disciplinary team in order to determine his level of functioning in all areas of development.

MOTOR DEVELOPMENT

Both the Physical Therapist's report and the findings of the Orthopedic Consultant indicated that CW is profoundly motorically disabled; his gross motor abilities are below the six month age level and infantile reflexes are still present.

The Occupational Therapist's findings offer no hope for the development of self-help skills, however, observation and testing indicated that some degree of head control was present. This ability, coupled with a controlled eye gaze, has proven to be CW's key to communication.

SENSOPY ABILITIES

Next, hearing and vision were assessed.

To determine his speech reception thresholds, the Picture Spondee Test was administered in an audiometric sound suite. The test is a standardized audiometric procedure which allows the client to respond to words by eye-gazing at an array of pictures. CW's threshold for speech was found to be normal.

Visual examination revealed no problems.

SOCIAL-EMOTIONAL DEVELOPMENT

This aspect of CW's developmental abilities is his greatest strength. All social/emotional correlates of functional language which are prerequisite for using an augmentative communication device (Owens & House, 1984) are present. He attends to others as they speak, mantaining eye contact and waiting for and noting when a speaker pauses and expects a response. His response mode is via eye gaze at objects or pictures if provided for him, or at appropriate objects or people in the environment. When he wishes to terminate an interaction, he retreats by averting his gaze or by closing his eyes. Other responses are evidenced in facial expressions which unmistakably communicate basic emotions.

These characteristics were recorded by systematic observation in all of his environmental settings. His affective characteristics show his potencial for a wide range of emotional responses and they are

appropriately signalled. Most importantly, these emotional responses are evidence of reactive and interactive behavior which is prerequisite to communication.

COGNITIVE DEVELOPMENT

The most difficult area of development to assess in a non-vocal severely physically handicapped person is cognitive ability.

The school psychologist who tested CW relied primarily on observation and informal assessment. Selected items from the Stanford-Binet, Form LM, were also administered and an eye-gaze response mode was accepted. The performance level on these items correlated with the overall impression that CW is functioning in the moderately retarded range.

SPEECH/LANGUAGE DEVELOPMENT

Finally, a speech/language evaluation is needed to complete the profile of strengths and weaknesses.

As a part of the speech/language evaluation, oral motor abilities were assessed. There are no structural deviations which would interfere with speech development, however, the severe neuromotor disability has precluded the development of even normal vegetative functioning. Drooling is present, though mild, and a poorly coordinated chewing pattern coupled with a primitive tongue thrust swallow pattern present a poor prognosis for the development of the control and coordination required for speech.

Receptive language development was tested by modifying a standardized test, the Test of Auditory Comprehension of Language (Carrow, 1973). The format of this test has the examiner ask a question or make an incomplete statement, and the child must point to one of three pictures to indicate his response. The test book was disassembled and each picture was mounted on cardboard. The examiner sat opposite the child with an

acrylic board between them. The array of pictures was clipped to the board prior to each item and CW's eye gaze could easily be noted as he selected his response. His score was in the same age range of other tests, approximately three to three and one-half years.

In summary, CW's developmental profile is that of an excellent candidate for augmentative communication. He has profound motoric disabilities, but exhibits social/emotional readiness for communicative interaction. His cognitive ability, though in the moderately retarded range, is a mental age of 3½ years which is certainly adequate for communication.

A review of our findings indicates that CW's weaknesses preclude the development of spoken language, however, his strengths predict success for augmentative communication.

II. Training the Child to Respond Utilizing a Single-Switch Response Mode

There is much evidence now indicating that profoundly retarded and multiply-handicapped children can learn developmental skills, when provided with a means of controlling their reinforcers.

One of the most intriguing concepts developed by psychology in the past 10 years is that of "learned helplessness". Seligman (1975) stated that learned helplessness results when a person expects that the important events or outcomes in his life are independent of his own responding. It is hard to imagine anyone with less control over what happens than a profoundly retarded or multiply-handicapped child. Often they are fed, changed, talked to, bathed, etc. based on someone else's schedule. They are passive recipients of whatever the environment has to deal out. Seligman writes that helplessness produces three deficits: it weakens the motivation to respond, it retards the ability to learn

that responding works, and it results in emotional disturbance. Smith (1978) indicates that the way to remedy and/or prevent helplessness is to show the individual that he can control his environment and that he can be effective in producing desired outcomes. It may be necessary to provide such individuals with learning situations that foster such an awareness (Brinker & Lewis, 1982). Concomitantly, one should see increased motivation, faster learning of new responses, and improved affect of the handicapped individual.

A number of manipulative devices have been devised through the Trudeau-Zambarano Active Stimulation Program (T.Z.A.S.P.) for simple motor responses of profoundly handicapped children. According to Zuromski (1979) the basic goal of Active Stimulation Programming (ASP) is to produce operant-based activities which function as prosthetic learning activities which even the most severely disabled child can perform. In using ASP, a device can be provided for the child which interfaces him with his environment and facilitates his control over that environment. This would include single switch devices such as a head switch, push panel, or a barrel switch. In addition ASP activities require that environmental events be arranged over which control can be exerted. The events may consist of such things as music, toys, or computer operation and these events would function as reinforcers. It is also possible with ASP to program certain environmental events, such as presentation interval for the reinforcement, by utilizing timing relays and other control devices. The activities are arranged so that when the child makes the desired movement and a satisfying event or reinforcer follows, the child will repeat the movement in order to produce the event again (Appendix A).

The ASP activities may function as precursors to utilization of and interfacing with the microcomputer. Brinker and Lewis suggest that three factors must be considered prior to contingency intervention and ASP incorporates these factors into their programming activities. They include the following steps:

(1) Identify movement which the individual is capable of making and which is a well-established part of the individual's movement - a neuromotor exam and trials with the toys or reinforcers will permit the custom design of an appropriate switch. This step provides the child with the opportunity to learn, often for the first time, that he can reliably control something in his environment. It also insures that an appropriate switch can be prescribed. It is important at this step to consider positioning of the child to inhibit infantile reflexes, so that the motorically involved child will be able to exert voluntary control in activating a switching device.

(2) Arranging switch closure - this will be based upon identifying the best movement capabilities of the child. A switch may include one which is activated by pushing a panel, raising an eyebrow, thrusting the tongue, etc. Accrino and Zuromski (1979) describe construction of devices to be used with multiply-handicapped individuals, including a description of the behavioral prerequisites needed for use of the device, materials needed for construction of each device, approximate prices, and instructions for building each switch. Coker (1984) also describes inexpensive materials to assist in the evaluation and training of electronic augmentative communicative potentials of nonspeaking physically handicapped persons.

(3) Selection of the consequent event - the reinforcer should be one desired by the child and may be of many types including auditory

(music, TV, recordings of parents' voices, etc.), visual (lights, slides, etc.), or auditory-visual (toys, computer with voice synthesis). It is also important to determine at this time the location for the reinforcer and the interval of reinforcement presentation.

In conclusion, it is important to assess the severely physically handicapped individual's ability to utilize simple electromechanical switches. This must be done prior to the development of an augmentative communication program. Automation of contingencies utilizing switches and other control devices, such as timing relays, will provide additional freedom to the teacher to observe other aspects of the child's behavior during the learning process. In addition, experience of some contingencies in non-social contexts may be necessary for children to discover that consequences are truly under their control. Movement or activation of a single switch can be interfaced with the microcomputer so that the individual's response produces a switch closure via a simple adaptor attached to the microcomputer. Subsequently, the microcomputer can make a unique contribution to language intervention with handicapped children by functioning as a language prosthesis and facilitating their immediate participation in language (Brinker & Lewis, 1982). By utilizing appropriate switches for input to and interfacing with the microcomputer, opportunities for acting upon and interacting with the environment will open up an entirely new world for handicapped individuals.

III. Considerations in Choosing a Speech Output System

Perhaps one of the most promising applications of microcomputers as augmentative communication devices lies in their ability to perform speech functions for non-vocal individuals. Through interfacing with

synthetic speech systems, the computer may be programmed to actually speak for the client, thereby giving voice to his communicative endeavors.

The audio output of such systems must be both socially acceptable and intelligible. Although there are research quality synthesizers which meet these criteria, they are far too expensive for use in the typical educational or therapeutic setting. We believe that those small-system products which are affordable, and available for interfacing with microcomputers, lack the acceptability and high degree of intelligibility demonstrated by true state-of-the-art systems.

Further, we believe that these products are inappropriate for use with handicapped populations. These individuals frequently exhibit problems other than an inability to speak, such as mental retardation or auditory perceptual problems, which may preclude their understanding or use of degraded speech signals.

As we demonstrate three speech synthesizers commonly employed in service of communication needs, you may formulate your own opinion of their intelligibility and acceptability. These products (Appendix B) represent the three technologies now available to small-system synthesis: (1) linear predictive coding, represented by the Echo II Speech Synthesizer; audio output is derived from a mathematical modeling of the vocal tract; (2) pulse code modulation, an analog-digital-analog conversion process, represented by Moutain Computer's Supertalker; and (3) formant coding, in which the output results from a mathematical modeling of the acoustic properties of individual phonemes; represented by the Votrax Type-n-Talk (Chial, 1985).

It is immediately apparent that, even though some systems can be adjusted to improve social acceptability, intelligibility remains a key issue.

There has been, to date, no systematic, published research on the intelligibility of small-system synthesizers though their use in augmentative communication is widely accepted.

A series of studies has been designed at Southeastern Louisiana University to perform the essential objective evaluation of the techniques employed in microcomputer-based synthesis. A preliminary study of consonant-vowel (CV) intelligibility has recently been completed, and indicated a statistically significant difference between natural speech and computer-generated speech.

Further studies will test the three synthesis methodologies with phonetically balanced words, rather than with CV syllables, and will be extended to gather both normative data and data from particular handicapped populations. Further, spectrographic analysis will be performed to determine if the known acoustic cues used to perceive natural speech are present, absent, or distorted in "computer speech".

The information generated from this research will permit more knowledgeable, effective interfacing of the special client to a speech output device; that is, it will foster the best possible match, at least on one parameter, of child to computer.

IV. Matching the System to the Child-A Case Study

The developmental data gathered by formal and informal testing confirm that CW is a candidate for augmentative communication. Without such a system, this child would never realize his potential as a socially interactive person capable of intellectual growth, and a fulfilling life. Instead, he would assume and remain in a state of "learned helplessness".

Interfacing the Child with the Computer

CW's key to communication is through controlled head movement and eye-gaze. Using a specially devised, battery-operated light pointer affixed to a head-band, he will beam the light at the symbols which represent his intended message. This light pointer, which will be commercially available in April, 1985, provides an intense red beam which can be adjusted in diameter for close and distant targets. It can be seen even in normally illuminated rooms, which is most important.

This light pointer is designed to electronically interact with a peripheral board interfaced with a microcomputer. This electronic linking of the board to the computer is made possible by use of the Adaptive Firmware Card developed by Paul Schweda (1984). This card allows access to the computer by any number of switching or light beam devices.

The board may be set up so that it is identical in arrangement to the actual keyboard of the computer but different only in size. The light beam, when aimed at a target will activate the same response as if an actual key on the computer had been struck. The board may be configured quite differently from the keyboard, if desired. For example, in early training as few as two or four large symbols may be used. Eventually, as the child gains better control, the peripheral board may be arranged in any manner that best suits his communication needs. It may include combinations of symbols, photographs, and line drawings with preprogrammed spoken and/or written output of words and phrases. It may ultimately be identical to the keyboard if the child learns to read. This possibility must not be ruled out before he has been given the opportunity to communicate.

Considerations in Selection of a Symbol System

A considerable portion of CW's educational experience has centered on picture vocabulary training. Conventional communication boards use pictures arranged in groups or categories permitting sentence or phrase construction. This format can also be utilized with the system just described. These photographs of CW, for example, can convey messages such as "I'm tired", "I want to get up", "I'm hungry", "Let's do my lesson", etc. Pictures, however, are inadequate as a complete communication system. They may effectively represent concrete ideas, but more symbolic linguistic messages cannot be communicated.

What can be used as a symbol system for the non-reader if pictures are ruled out? There are several symbol systems available, among them are Rebus, PicSyms, and Blissymbols.

In choosing a symbol system for use with a communication device, several factors must be considered. The symbol system should:

1. Be compatible with the aid or technique with which it will be used.
2. Place the least amount of restriction on the child's communication.
3. Be appropriate to the child's current expressive ability.
4. Be developmental and flexible in order to allow for the child's changing communication needs.
5. Be adaptable to current therapy and educational procedures and approaches.
6. Be acceptable to the child, his parents, and teachers and those with whom he will communicate.

The System of Choice-Blissymbolics

Of the available symbol systems, only Blissymbolics meets the aforementioned criteria. Blissymbolics is a system which uses defined Blissymbols according to prescribed rules. Some of the symbols are pictorial, others are ideographic. A third group are common arbitrary symbols such as +, -, or ?, and a fourth group contains arbitrary symbols defined by Bliss (1965). Charles K. Bliss, the creator of Blissymbols, originally conceived of this system as a language for world communication, an international language. The system was largely ignored for this purpose but, fortuitously, a teacher at the Ontario Crippled Children's Centre in Toronto, Canada accidentally saw Bliss' book on this subject in a library. She believed the system might have use by some of her students who were non-vocal and cerebral palsied, thus in need of an alternative form of communication. Since this first use in Canada, Blissymbolics has been widely used as a nonverbal system for the handicapped. A more complete description of Blissymbols and a sample vocabulary is included in Appendix C.

Advantages which accrue to using this system, are as follows. Blissymbols:

1. Were designed and developed specifically for communication.
2. Vocabulary has been selected to form a functional set for communication.
3. Can be used with any individual from the prereading level to use as a second language.
4. Are standardized and easily understood between users.
5. Provide a common, orthographic representation of the symbol for message reviewers who have not learned the symbols.

6. Are commercially available, and extensive research and dissemination efforts have been undertaken by the Blissymbolics Communication Foundation.

Mention should also be made of the following disadvantages:

1. The symbols are relatively new and there is no longitudinal research available on the advantages/disadvantages of their use as a symbol system.
2. The symbols may initially appear visually complex and confusing to the user, and to the message receiver.
3. Appropriate application of the symbols may require attendance at a special training/certification workshop.

The advent of the Talking Blissapple Program (1982) provided further impetus for choosing Blissymbols as a communication system. This software program has options for print and synthetic speech outputs as well as display of the symbols on the monitor of the microcomputer (Appendix D).

The projected plan for CW is, as described earlier, to use the peripheral board activated by a beam of light directed by his head movements. Initially, just a few symbols will be placed on this board, and then, as his vocabulary grows, several overlays will be provided for the board. Each will display a vocabulary pertinent to different activities and/or environments.

Ultimately, the Talking Blissapple Program will be fully implemented. This program provides over 1400 pre-programmed symbols and can be expanded. In this program, each symbol has a number and the user selects each symbol by entering its number. This may be done by shining a light beam on the appropriate numbers on the peripheral board. This selection

mode will require a more complex set of response behaviors. He must locate from a large set the symbol of choice, he must then note the number on the symbol and retain that number in short-term memory, and finally enter that number into the computer.

If CW can master these techniques his communication will be immeasurably enhanced as compared with the direct selection of symbols from a small array on the board.

As we are still awaiting the commercial availability of the light pointer, we will demonstrate the Talking Blissapple Program using a joystick as an access mode. Any single switch device can be employed just as the joystick or game paddle is used in this demonstration.

DEMONSTRATION

In summary this system permits the child to direct a light beam by head movement at a sequence of symbols on a board. The computer is programmed to display the symbol sequence on its monitor and on command will speak the message and/or print out the message. The child can delete and add to his messages by simple commands and such editing can be done prior to print or speech output.

The above described communication system lends itself for use in interactive conversation, in independent writing and in computer-assisted instructional programs.

Our research and field-testing of the hardware, software, and symbol systems described herein have given us cause to be cautiously optimistic. We conclude with these final observations. The technology will never substitute for good teaching. The child must have the

cognitive potential to learn - the therapist must have the information and creativity to teach - and both child and therapist must have the cooperation and support of family and school personnel. The microcomputer simply allows the child to give expression to the language he has learned.

APPENDIX A

A.S.P. Curriculum Index

The A.S P. Curriculum has activities in these area:

1. Gross Motor
2. Fine Motor
3. Sensory Motor
4. Receptive Language
5. Expressive Language
6. Cognition

A plus indicates that the switch listed to the left can be used to develop the movement listed above. The actual activity can be located by refering to the area indicated at the bottom.

A.S.P. Curriculum Movements	non directed arm or leg movement	directed arm or leg movement	head control	reach, push	pull, grasp	wrist rotation	discrimination	increase attending behavior	contingency awareness	maintain a response
Switches										
push panel		+	+	+			+	+	+	+
mercury switch	+		+	+			+	+	+	
joystick		+		+	+		+	+	+	+
lever panel		+		+	+		+	+	+	+
micro lever switch	+	+	+	+	+		+	+	+	+
controflex			+		+		+	+	+	+
doorknob switch						+	+	+	+	
barrel switch		+		+			+	+	+	
mobile		+		+			+	+	+	+
Location within Curriculum by area	1	1,2	1	2	2	2	3,4 6	5	6	1,2 6

APPENDIX B

SUMMARY OF DEMONSTRATED VOICE OUTPUT DEVICES

ECHO II SPEECH SYNTHESIZER

Street Electronics Coporation
1140 Mark Avenue
Carpinteria, CA 93103
$149.95 (list)

The ECHO II generates speech via Texas Instruments' TMS 5200 speech processor which models the human vocal tract using Linear Predictive Coding (LPC).

The Speakeasy program within ECHO II generates speech at the phoneme level. This allows for greater animation and more "on target" pronunciation of words. Speakeasy may be programmed for variable volume, pitch, rate, stress, and pause intervals.

SUPERTALKER

Mountain Computer, Inc.
3800 Harvey West Blvd.
Santa Cruz, CA 95060
$199.00 (list)

The SUPERTALKER provides the user with the ability to digitize human speech and store it on diskettes. The Vocal Preparation System allows the creation of personalized phrase diskettes that may contain words, phrases, or sentences.

The quality of recording may be adjusted via selection of digitizing rate; the higher the rate the better the quality. Four rates are possible: 512 Bytes/sec., 1024 Bytes/sec., 2048 Bytes/sec., and 4096 Bytes/sec.

Output volume may also be adjusted.

TYPE-n-TALK

Votrax, Inc.
1394 Rankin
Troy, MI 48083
$189.00 (list)

The Votrax TYPE-n-TALK synthesizes by formant coding and features a programmable unlimited vocabulary. System routines include text-to-speech and phoneme-to-speech translation.

Frontal panel controls are provided for manual adjustment of amplitude and pitch; pitch control also varies rate of speech.

APPENDIX C

WHAT IS BLISSYMBOLICS?

Eugene T. McDonald, Ed.D., Director

Approved Blissymbolics Training Center
The Home of the Merciful Saviour for Crippled Children
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As a result of growing publicity about the use of Bliss symbols in programs for handicapped children, many people are requesting information about this method of communication. It is not possible to describe Bliss symbols and the system of Blissymbolics in a few paragraphs. This discussion can only introduce the reader to a symbol system which is enabling many communicatively handicapped persons to express thoughts, ask questions and describe feelings.

Blissymbolics was developed by C. K. Bliss whose childhood experiences in a multi-lingual Austrian community, as chief of the patents department in an electronics firm, and as a Jew in Nazi Germany led him to believe that many of mankind's problems are traceable to our use and our misuse of language. He set out to create a universal symbol language which people could read no matter what their spoken language. In 1949 he published Semantography which described a system of symbols which have their basis in meaning rather than sound. He envisioned that his symbol system would be used as a universal language in diplomacy, international commerce, travel, and similar high level communicative situations. Despite his vigorous promotion, his work was generally ignored until it was discovered by Shirley McNaughton, a teacher at the Ontario Crippled Children's Center, in Toronto. It has been exciting to see handicapped persons, including many who are low functioning, learn to communicate via Blissymbols when they could not learn to speak intelligibly or to read traditional orthography. A 17 year old, non-speaking, spastic quadriplegic of our recent acquaintance was a long-time resident of an institution for the mentally retarded where he led a life of a totally dependent, passive recipient of attention. Even though his I.Q. had been estimated at about 20 and he had not shown much progress in earlier speech or academic training, symbol training was initiated, and in less than a year he not only was communicating with those around him but dictating letters using short simple sentences. As a recipient of two of his letters I have seen how the use of symbols has improved the quality of his life. He is but one of many. Some higher functioning, non-speaking persons use Blissymbolics to communicate sophisticated thoughts and express complex emotions. It is being learned and used by mentally retarded, multi-handicapped, deaf, aphasic and autistic persons.

Blissymbolics is more than a set of symbols. It is a visual-graphic communication system based on meaning with no phonetic associations. (Perhaps this is why the system can be learned by children who can't

learn to speak or to read traditional orthography which is sound referenced.) The symbols are line drawings composed from a relatively small number of symbol elements. Using a logical system, these basic elements are assembled in various combinations to represent thousands of meanings. Except for a few arbitrary symbols (many of which are in wide use, e.g., the numerals; punctuation marks; and the plus, minus, multiplication, division and equal signs), symbols are based on a logic which facilitates interpretation and retention of their meaning. All symbols in a message are drawn to the same scale with a square as the frame of reference. Several factors determine symbol meaning: configuration or shape of the symbol, symbol size, position within the square, direction of symbol parts, spacing between parts, and the use of a pointer, number, or positional referent. The meaning of a symbol can be changed by the use of an appropriate indicator. The same symbol drawn with different indicators might represent a thing, an action (present, past, future), an evaluation, or be a singular or plural. Several techniques, called strategies, are available by which a symbol user can indicate that a meaning different from the conventional translation of a symbol is intended. Bliss attempts to simplify grammer to the minimum essential for clarity of expression. Rules guide the ordering of symbols in a variety of sentence forms. When used correctly the system is a powerful communication mode. Correct use requires accurate drawing of symbols and observance of the grammer rules.

At this time only a little is known about how communicatively handicapped children learn symbols, what symbols they need to learn, and how they should be taught. During the coming years much will be learned through research and careful clinical observation. For their contributions to be meaningful it is imperative that the researchers and clinical observers know the symbols and the symbol system. A superficial acquaintance with the symbols is not sufficient for teaching them or for conducting any type of investigation using Bliss symbols. Many hours of careful study of Blissymbols and practice in the use of Bliss symbols should be prerequisite to their application in research or teaching.

In 1975, the Blissymbolics Communication Foundation (now Institute) was established as a non-profit, charitable organization. Through a legal agreement with C. K. Bliss, the Institute has received a perpetual, exclusive, world-wide license to use, publish, teach and disseminate Blissymbolics. The B.C.I. offers in Toronto or, by special arrangements, in other areas elementary workshops (4 or 5 days) which cover basic instruction in Blissymbolics and its applications. Special interest workshops and internship training are also available in Toronto. In the United States training programs are offered in several centers.

At the Home of the Merciful Saviour for Crippled Children in Philadelphia, Pa., a combined correspondence study-workshop program is offered each spring and fall. This course covers the same content as the elementary workshops conducted by B.C.I. Persons who complete the five correspondence lessons and attend the two-day workshop in Philadelphia receive a certificate from B.C.I.

These Blissymbols are suggested as a core vocabulary for preschool children. Supplementary vocabularies which meet a child's specific needs, e.g. names of family members, friends, etc. are also important.

I, me	you	they, them	(to) like
baby	girl	boy	(to) want
what thing	woman	man	(to) walk, go
who	mother	father	(to) see
food	clothing	house	book
(to) drink	container	outing	paper, page
wheelchair	animal	show place, theatre	pen, pencil
motor car	sick	school	story

(to) come	in, inside	a, an	happy
(to) give	on	the	sad
(to) have	to, towards	with the help of	big
(to) make	for	not	little, small
chair	cupboard	tree	sun
table	colour	flower	rain
bed	night	country(side)	record
toilet	day	bird	gathering

APPENDIX D

Brief Overview of BLISSAPPLE Program

The BLISSAPPLE is a software program developed at Trace Center, University of Wisconsin, intended for use with any standard Apple II computer with 48K of memory and one disk drive. The BLISSAPPLE turns the computer into a self-contained talking Blissymbol writing/printing aid.

The vocabulary of the BLISSAPPLE is completely user-determined. A library of over 1400 pre-programmed symbols is available which can be selected and put in the user's vocabulary.

The program is designed to be self-starting. Th disk can be left in the disk drive when not in use. Then, whenever the power is turned on, the program will automatically load itself and start up when the user hits his input control.

The basic use of the BLISSAPPLE in communication is essentially the process of selecting words from a vocabulary by specifying each word's vocabulary code number. Special control commands (such as PRINT MESSAGE, CLEAR SCREEN) may also be included into the vocabulary and selected by code number or by specifying the command name directly.

The BLISSAPPLE can operate in a variety of user input modes, selected at the start of the program. However, the Apple keyboard can also be used with any input mode. This ability to automatically switch between the keyboard and other input modes is useful in allowing a teacher to demonstrate something or to make a change in the vocabulary, or to allow the user to carry on a conversation with someone else who uses the keyboard.

The Joystick Mode allows an individual to enter the Blissymbol codes by directly indicating the numbers from the number line on the bottom of the screen. With the joystick mode activated, the numbers 0 through 9, along with ">" and

"!" appear along the bottom of the screen. Immediately above is a small cursor. To select numbers from the screen, the individual uses the joystick to move the cursor over the desired numerals. When the cursor stays over one of the numerals for a preset, but adjustable, period of time, the BLISSAPPLE will accept that numeral as part of the code being entered. When the user is finished with a selection, he moves the cursor over the "!", which causes a (RETURN) to be entered. The program will then add that symbol to the individual's message on the screen. If the individual makes a mistake, he can use the " > " as a backspace and remove the last numeral entered.

Once the user has created a message, he can print the message, clear the message, delete the last symbol, etc. These commands have certain 1 or 2 letter mnemonic codes which can be entered from the keyboard.

The BLISSAPPLE actually has three vocabularies: ACTIVE, USER, and LIBRARY. The Active Vocabulary is the main working vocabulary of the program. It is temporary, and exists only while the computer is turned on. A copy of the User Vocabulary on the diskette is automatically loaded into the Active Vocabulary during the power-up routine when the computer is turned on. The User Vocabulary is created from symbols in the Library, and is a remembered vocabulary on the disk. The original Library contains all BLISSAPPLE commands, and also 1443 Blissymbols, put in the code range of 100 to 1542. The commands and symbols can be arranged according to the user's preferences/needs.

BLISSAPPLE commands are organized into three levels. The first level, indicated by the prompt " > " on the screen, authorizes execution of only the safest, most basic commands. These include commands which create and modify messages, as well as those to control the format and printing of these messages The second level, indicated by an "*" prompt, authorizes commands to create new symbols in the vocabulary. The third level is indicated by the prompt "$"

which authorizes execution of commands in all three levels. Its commands can affect the two remembered vocabularies on the diskette.

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